(12) UK Patent Application (19) GB (11) 2 335 081 (13) A

(43) Date of A Publication 08.09.1999

(21) Application No 9804712.9

(22) Date of Filing 05.03.1998

(71) Applicant(s)
NEC Technologies (UK) Ltd
(Incorporated in the United Kingdom)
Castle Farm Campus, Priorslee, TELFORD, Shropshire, TF2 9SA, United Kingdom

(72) Inventor(s)
Rupert James Waldron

(74) Agent and/or Address for Service
J W White
NEC Technologies (UK) Ltd, Level 3, The Imperium, Imperial Way, READING, Berks, RG2 0TD, United Kingdom

(51) INT CL[6]
H01Q 1/24 9/30 13/10

(52) UK CL (Edition Q)
H1Q QDP QDW QKE

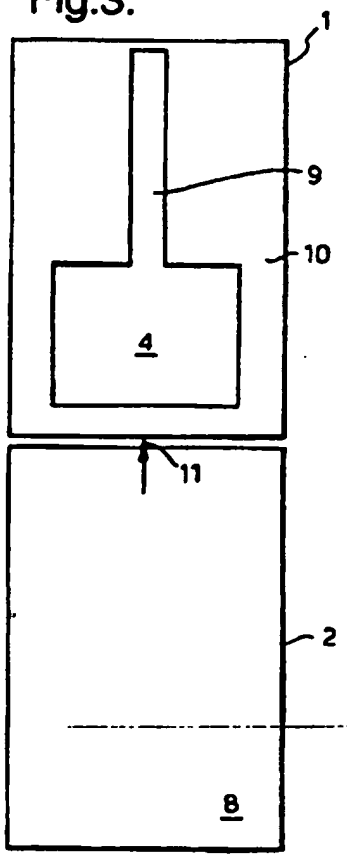
(56) Documents Cited
GB 2292482 A GB 2283682 A GB 2255460 A
GB 2236625 A

(58) Field of Search
UK CL (Edition P) H1Q QDP QDW QDX QKA QKC QKE QKN
INT CL[6] H01Q 1/24 9/30 13/10
On-line: WPI, EPODOC, JAPIO

(54) Abstract Title
Antenna for mobile telephones

(57) A folding mobile telephone has two main housings connected by and rotating about a hinge. An antenna is switched between normal (open) and standby (closed) positions. In the open position shown, a slotted 4 plate 10 contained in a first housing in combination with a planar conducting sheet 8 in a second housing acts as a monopole antenna. When the two housings are moved together about the hinge to the standby position the slotted 4 plate 10 acts as a slot antenna and the planar conducting sheet 8 forms a reflector. The antenna is not visible to the user.

Fig.3.



GB 2 335 081 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

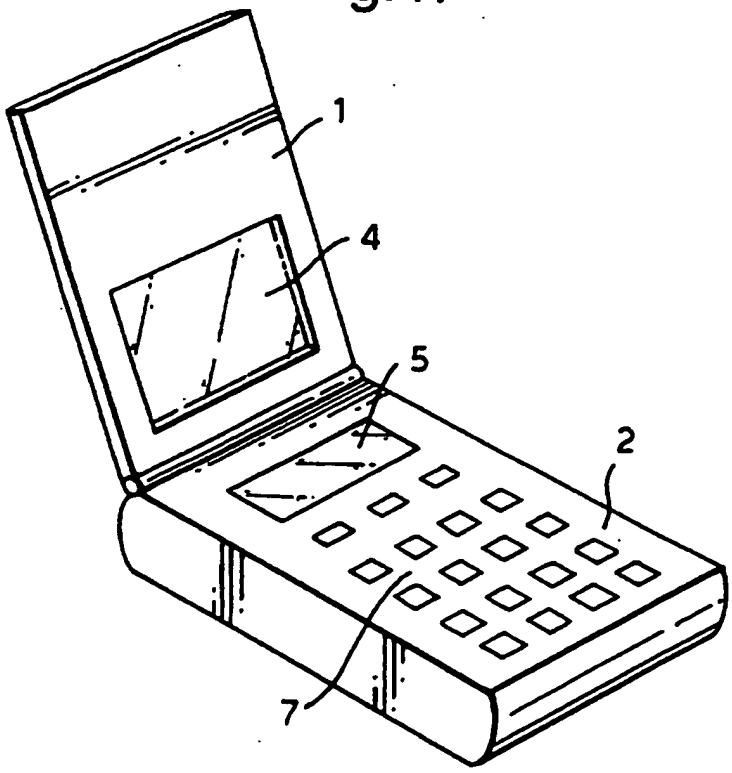


Fig.2.

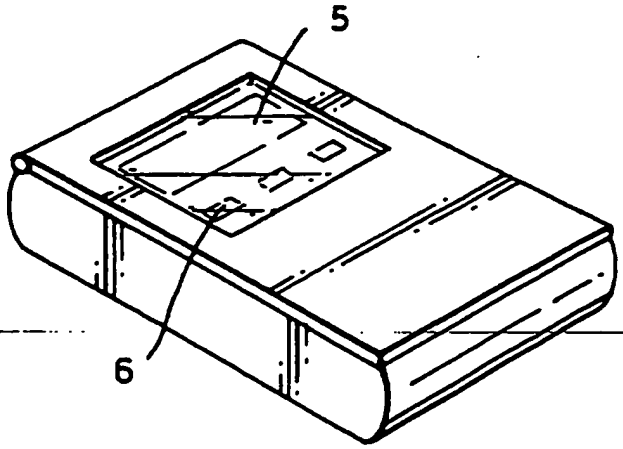


Fig.4.

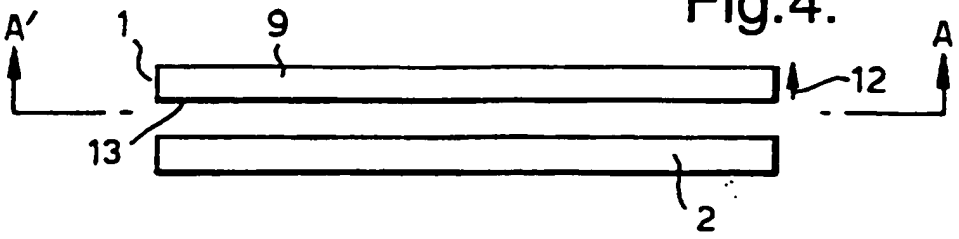


Fig.3.

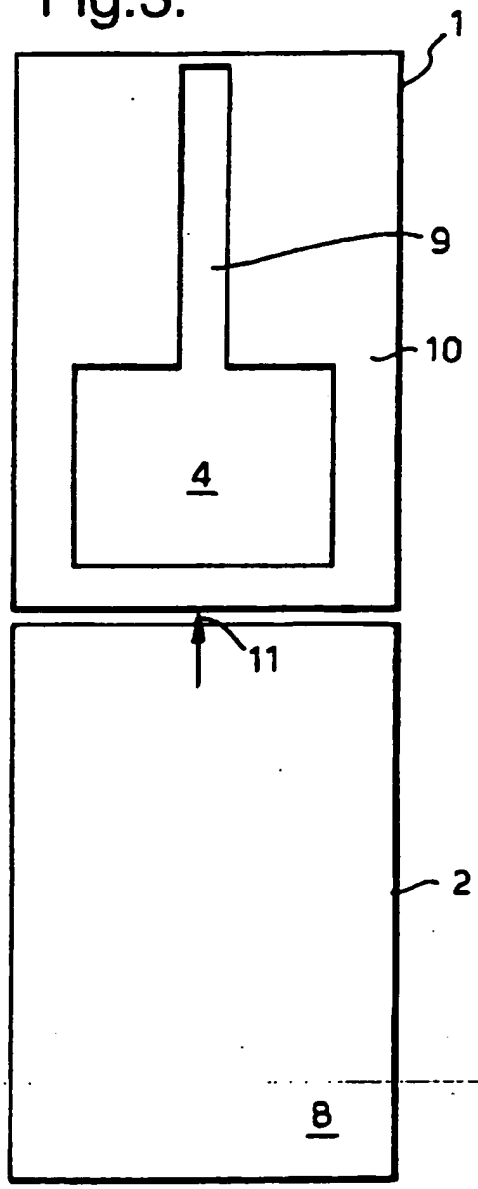


Fig.5.

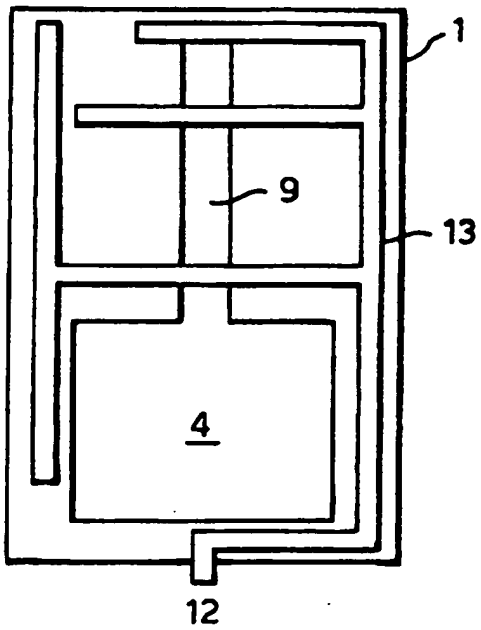


Fig.6.

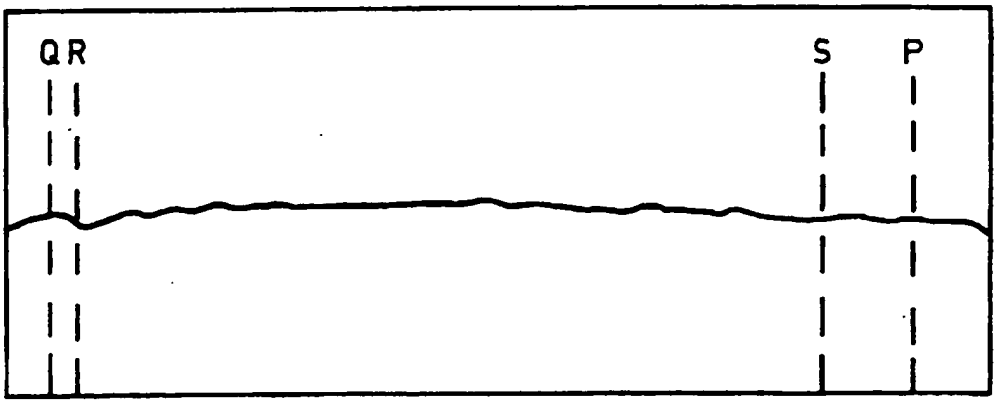
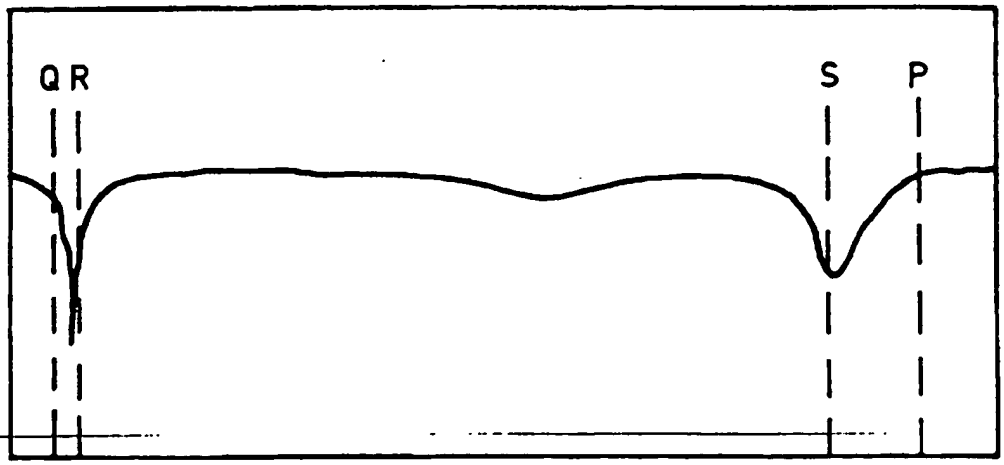


Fig.7.



Antenna for mobile telephones

This invention relates to antennas for use with mobile telephones.

The design of antennas for mobile telephones capable of operation in more than one frequency band (dual mode) is constrained by the market demand continually to reduce the overall size of telephones. An antenna for a foldable telephone or "flip" phone as it called, will need to be especially compact while still being capable of providing satisfactory performance.

A typical foldable phone is illustrated in figures 1 and 2 and comprises two main sections connected by a hinge mechanism. When such a telephone is in the closed position, performance of the antenna must be sufficient to enable the satisfactory reception of incoming signals. The phone is normally used in the open position as shown in figure 1 but incoming calls as well as text and data messages must be received when the phone is in the closed position.

Conveniently the top section of the phone will include a window for providing viewing access to a display screen or direct access to part of a keypad when the phone is in the closed position. The display screen and keypad would usually be located in the bottom section of the phone.

Preferably the antenna will be incorporated into the phone so that the antenna is out of sight of the user

According to the invention there is provided a dual mode antenna for use with a folding mobile phone said antenna switched between normal and standby positions, in the normal position, the antenna acting as a monopole comprises a planar conducting sheet in combination with a slotted plate and in the standby position the antenna comprises said slotted plate acting as a slot antenna with the planar conducting sheet forming a reflector.

One example of the invention will now be described with reference to the figures in which:

figure 1 shows a foldable phone in the normal position.

figure 2 shows a foldable phone in the standby position

figure 3 illustrates the antenna in the open position

figure 4. illustrates the antenna in the closed position

figure 5 is a view along A-A′ of figure 4.

figure 6 is a plot of antenna gain for the phone in the open position

figure 7 is a plot of antenna gain for the phone in the closed position

With reference to figure **1**, a flip phone is shown in the open position with the top section of the phone **1** and bottom section of the phone **2** . An aperture **4** in the top section **2** gives access, when the telephone is closed, to the visual display **5** and part **6** of the keypad **7** located in the bottom section **2**.

With reference to figure 3 which illustrates the antenna in the normal position, the bottom phone section **2** includes a copper sheet **8** whose area is the slightly less than that of the bottom section **2**.

The top section **1** also incorporates a copper sheet **10** but the top section copper sheet has been cut to provide a slot as shown at **9** in figure 3. The width of that part of the slot **9** shown at **4** has been increased to form an aperture suitable for access to part of the bottom section **2** when the telephone is in the closed position. Where only visual access is required, the part **4** of the slot **9** in the slotted plate increased to provide access may be filled with a transparent material such as injection moulded polycarbonate or polymethyl methacylate (PMMA).

The top section copper sheet **10** in this arrangement is formed on one side of a printed circuit board (PCB). When in the normal operating position, the open position as illustrated in figures 1 and 3, the antenna comprises, in combination, the bottom copper sheet **8** and the upper copper sheet **10** (with slot) acting as a monopole.

It has been found by experiment that a significant increase in the width of part of the slot at **4** to provide an aperture for access purposes does not degrade the performance of the antenna significantly. Excitation of the antenna in the normal operating position is via a coaxial lead across the edges of the two copper sheets at **11**.

With reference to figure 6 which is a plot of reflection coefficient for the normal operating position, it can be seen that a satisfactory gain is achieved for both frequency bands.

The antenna gains with reference to 0dBm at the points marked on the plot (figure 6.) are:

P, -8.8098 dB at the frequency 1.805 GHz

Q, -6.8373 dB at 935 MHz

R, -6.7082 dB at 960 MHz

S, -8.3531 dB at 1.71 GHz

With reference to figure 7 which is a plot of reflection coefficient for the standby operating position, it can be seen that considerably more variation in reflection coefficient is experienced than for the normal operating position. Nevertheless the performance in the standby position provides satisfactory performance and the reflection coefficients with reference to 0dBm at the points marked on the plot (figure 7) are:

P, -2.6055 dB at the frequency 1.805 GHz

Q, -5.8452 dB at 935 MHz

R, -14.885 dB at 960 MHz

S, -15.903 dB at 1.71 GHz

In figure 4 a simplified cross-sectional view of the phone in the standby (closed) position is given. The antenna in this closed position operates as a slot antenna by means of the slot **9** in top section **1**. The antenna connection is switched (not shown) to the feed at **12** when the phone is closed. The microstrip line **13**, which can be adjusted to alter antenna resonances, is formed on the other side of the PCB to the slot and provides the excitation of the slot **9**. In the closed position, bottom section **2** does not form part of the antenna but acts as a reflector.

Claims

1. A dual mode antenna for use with a folding mobile phone said antenna switched between normal and standby positions, in the normal position, the antenna acting as a monopole comprises a planar conducting sheet in combination with a slotted plate and in the standby position the antenna comprises said slotted plate acting as a slot antenna with the planar conducting sheet forming a reflector.

2. A dual mode antenna as in claim 1 where the width of part of the slot in the slotted plate is increased to provide access to a visual display.

3. A dual mode antenna as in claims 1 or 2 where the width of part of the slot in the slotted plate is increased to provide access to a keypad.

4. A dual mode antenna as in claim 2 where the part of the slot in the slotted plate increased to provide access is filled with a transparent material.

5. A dual mode antenna as in any of the previous claims where the planar conducting sheet is a metal plating on a printed circuit board